

Ethica:



Using Smartphones to Put YOU at the Centre of Health Innovation

[Mohammad Hashemian](#)

Ethica Data
Toronto, Canada

[Nathaniel Osgood, Ph.D.](#)

Professor, Department of Computer Science
Associate Faculty, Community Health & Epidemiology
University of Saskatchewan
Saskatoon, Canada

Needs for Health & Health-Care Innovation



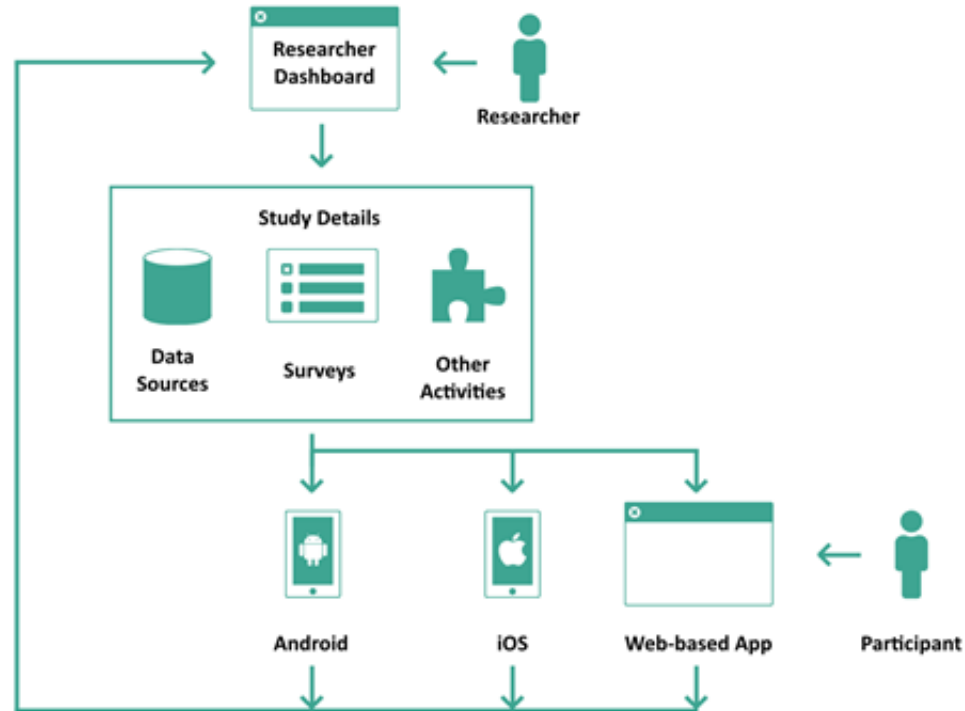
- Understanding of patient needs, experience, behaviours, exposures, challenges and outcomes in community
- Cohesive linking patient between care and community environments
- Patient satisfaction, particularly at point of care
- Understanding impact of intervention on patient behaviours, exposures, satisfaction

What is Ethica?



- Ethica is software which allows researchers to collect and analyze data on human behaviour, attitudes, beliefs, and exposures using web, smartphone, and wearable technologies.
- Used for 100+ studies with more than 10,000 participants, including by 30 universities across 8 countries. Ethica is available 9 languages, including English, French, German, Dutch & Urdu.

Ethica Components



Data Sources



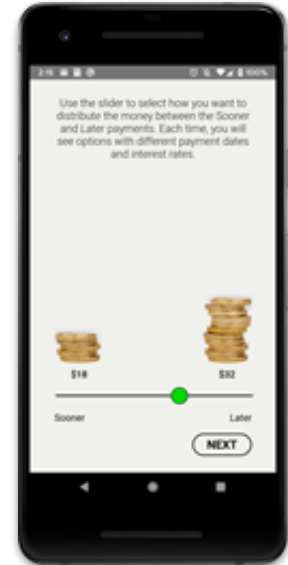
- Allow unobtrusive and automatic data collection on participant's behaviour.
- **Location Data** via smartphone's GPS and Wi-Fi sensors.
- **Physical Activity Data** via motion sensors such as raw accelerometry data, or processed pedometer data.
- **Contact Network Data** via Bluetooth Beacons.
- **Digital Footprint Data** such as screen time, app usage, call and text message reports.
- **Environmental Data** such as temperature, light, or humidity.
- **Wearables** such as Google Fit devices or Fitbit.

Participant Activities

- **Surveys** can be used to capture self-reported data from participant.
- **Cognitive Tasks:** Asked after the participant is joined and asks baseline questions.



Sample Survey



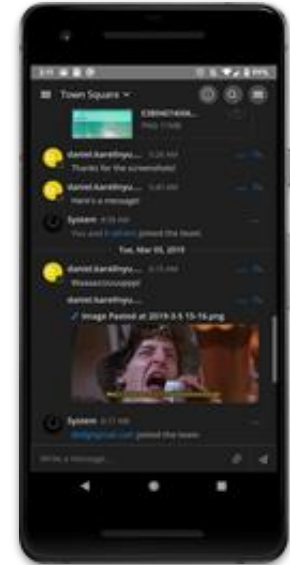
Sample Cognitive Test

Participant Activities

- **Time, Nutrition, & Expense Tracking**
Provides customized UI to collect data on time-use, food consumption, and spending behaviour of participants.
- **Custom Interventions**
Allows providing study-specific features and interventions to the participants.



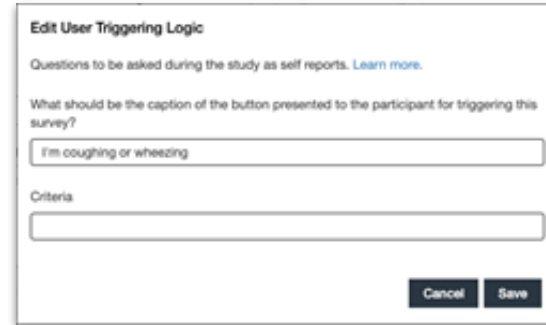
Time-use Tracking



Custom Interventions

Activities Started by the Participant

- Activities can be configured to be started by the participants, anytime they choose.



The dialog box is titled "Edit User Triggering Logic". It contains the following text: "Questions to be asked during the study as self reports. [Learn more.](#)" and "What should be the caption of the button presented to the participant for triggering this survey?". Below this is a text input field containing "I'm coughing or wheezing". Underneath is a section labeled "Criteria" with an empty text input field. At the bottom right are "Cancel" and "Save" buttons.

Activity Configuration Dialog



App UI

Activities Started at Specified Time

- Study staff specifies the time-table when the activity should be completed by the participant.
- Participant will receive a notification at that time.

The 'Edit Triggering Schedule' dialog box is used to configure when an activity is triggered. It includes sections for 'First Triggering', 'Repetition', and a 'Summary'.

First Triggering

When the first prompt should be triggered?
Note that all the trigger times are relative to the participant's enrollment date. So if a given participant joins on Jan. 1st 2018, the following times will be relative to Jan. 1st 2018.

Trigger between 1 days at 21:00 and 1 days at 21:00 and

1 days at 21:00 and 1 days at 21:00

Change time selection method: custom

Will be used to pick a random time from the specified time window.

Repetition

How many times do you want to repeat this survey?

☐ Don't repeat the survey (trigger only once).

☒ Repeatedly trigger the survey:

Repeat: Only

Repeat every 1 day

End repetition: ☒ Never

☐ After 1 occurrence

☐ After 1 days on 1 days

Summary

Description: First trigger on the 1st day between 21:00:00 and 21:00:00, using uniform distribution function, repeat every day, never ends.

Example Schedule: Assuming your participant joins on:

July 5, 2018, 7:08 PM

This survey will be triggered at:

- 1 Fri, July 6, 2018, 9:23 PM
- 2 Sat, July 7, 2018, 9:11 PM
- 3 Sun, July 8, 2018, 9:18 PM
- 4 Mon, July 9, 2018, 9:29 PM
- 5 Tue, July 10, 2018, 9:10 PM
- 6 Wed, July 11, 2018, 9:12 PM

Cancel Confirm

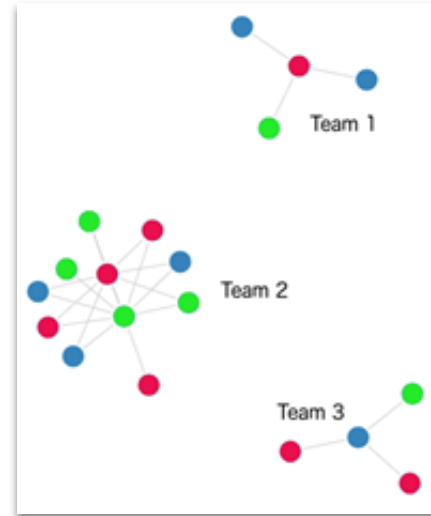
Activity Configuration Dialog



App UI

Activities Started by Context

- Ethica can detect participant's context using sensor data & use them to prompt surveys and other activities.
- **Bluetooth Beacons** can be used to detect individual's proximity to a physical object or actor.
- **GPS** can be used to detect presence (or absence) in a geo-fence.



Add new Proximity Schedule

Teams

Which team this survey should be triggered upon detecting proximity to its members?

☒ Only team members of teams with the same team ID as current user

☐ Only team members of this team ID:

☐ From all other teams

Rules

Which set of rules from the team(s) you selected above can cause the survey to be triggered?

☒ Trigger this survey when a contact has detected to any other role

☐ Trigger this survey only if a contact has detected between following sets

When this trigger should happen?

☒ Trigger this survey after visiting the subject for minutes continuously

☐ Trigger this survey minutes after departing from this subject, when they have been in contact for minutes

In general, when a subject is not seen in proximity for 10 minutes in a row, we consider it as departed.

Each prompt should be minutes apart.

☒ Filter baseline by RSSI

Minimum RSSI value:

Summary

Trigger the survey when visiting beacons from the same team, with any role, 30 minutes after arrival, with minimum RSSI value of . Consecutive prompts should be minimum of 60 minutes apart.

Beacon Mapping

Study UUID: 4203008

Add new proximity beacon

Participant Owned: ☒

Participant:

Team ID:

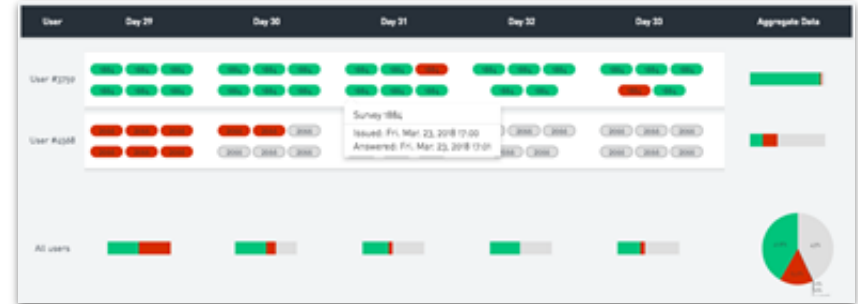
Role ID:

Subject ID:

Name	Major	Minor	
Beacon000001	0000	0000	<input type="button" value="Delete"/>
Beacon000002	0000	0000	<input type="button" value="Delete"/>
Beacon000003	0000	0000	<input type="button" value="Delete"/>
Beacon000004	0000	0000	<input type="button" value="Delete"/>
Beacon000005	0000	0000	<input type="button" value="Delete"/>

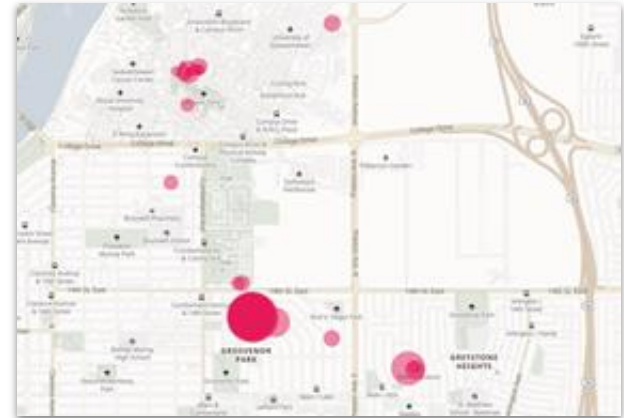
Real-time Adherence Monitoring

- Check the rate and volume of the sensor data uploaded per individual or across the study.
- Check the past and the future schedule of the participant activities, and their adherence.



Combining the Data

- **Survey responses** can be combined with **Location data** to identify where the participant completed the survey.
- **Location data** can be added to the **pedometer data** to identify where and how much participants often walk.



Value for Healthcare Decision Making



- **Self/informal:** “fingerprint of func.” / baselining, understanding triggers.
- **Clinical management:** Patient reported and autodetected outcomes, understand patient challenges, role of self- and informal-care, symptoms and contexts.
- **Health services delivery:** Understanding patient satisfaction at POC; Detecting barriers, inefficiencies and bottlenecks; quantifying key delays; identifying coordination challenges.
- **Operational decisions:** Prioritizing testing, faster outbreak identifying and localization, evaluating control strategies.
- **Strategic decision making:** Program evaluation, identifying high-leverage intervention and restructuring strategies.

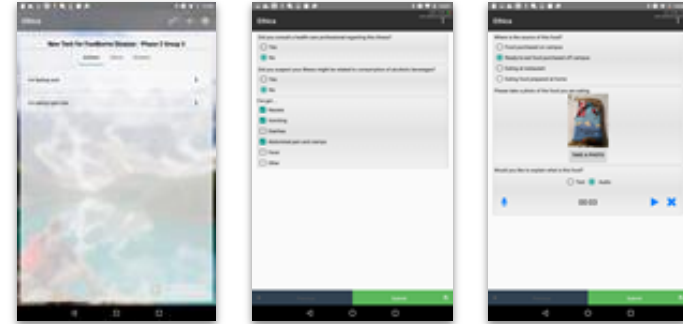
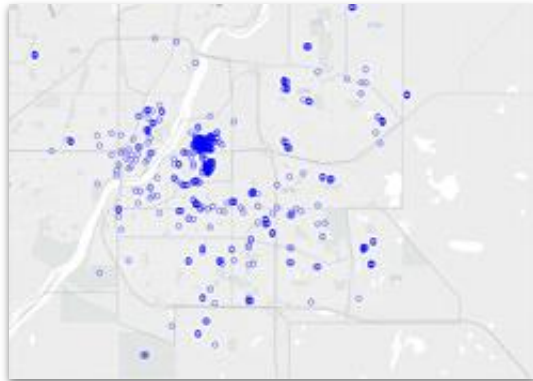
Case Study 1: Service Dogs & Veterans w. PTSD

- **Partners:** Colleen Dell (co-PI), Audeamus, U Regina, BCIT, RCMP
- **Duration:** 9.5 month
- **Sample size:** 36, 6 control case with companion animals
- **Data collection:**
 - Surveys, including photo & audio submission
 - Sensors
 - Physical activity & sedentary behaviour
 - Social contacts (via other beacons)
 - Location
 - Distance to beacon for paired dog
 - Fitbit (heart rate, sleep)
 - On Dogs: Bluetooth beacon on collar
- **Key Findings:**
 - Dog's impact on flashbacks, emotional support, social contact, isolation, physical activity, and substance use.



Case Study 2: Foodborne Illness

- **PI:** Cheryl Waldner (WCVN & School of Public Health), Public Health Agency of Canada as partner
- **Sample size:** ~100 participants
- **Duration:** 10 weeks
- **Key research questions:** Recollection of consumption, occurrence of non-presenting illness



Recent Illness



Case Study 3: Basic Income and Time Use

- **Sample size:** 3,000
- **Duration:** 4 years (2019 to 2023).
- **Key question:** How guaranteed basic income can impact people's time use habits.
- **Smartphone data collection:**
 - Location data to monitor time spent at different places.
 - Self-reported time-use tracking.
 - Physical activity data.
 - Screen time.
- The challenge was to find an easy method to measure participants' time use habits, without impacting their compliance in long-term.
- During a 5-month pilot, the compliance dropped from 89.69% at the end of the 1st month to 88.04% at the end of the 5th month.



Questions?

Next week: Bootcamp & Incubator on Understanding Health Behavior using Smartphones and Wearables.

Department of Computer Science,
University of Saskatchewan

<https://learn.ethicadata.com/events/>